Space Weather Technical Forecast

Issued on Thursday, 24 November 2022 at 12:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of Minor Geomagnetic Storm (G1) intervals.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with a number of weak C-flares occurring. There are 4 sunspot regions on the visible disk, all of which appear stable and relatively magnetically simple. AR3147 Hsx/Alpha and AR3149 Eso/Beta persist as mature features but with no notable development or activity occurring. 3151 Dao/Beta and 3152 Bxo/Beta are similarly unremarkable. No new Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind at L1 persisted at background levels, around 300 km/s. The density has been mostly above average, though steadily easing from a peak of 31 ppcc at 23/1336 UTC. The total IMF, Bt, was weak, below 6 nT with north-south component Bz, varying weakly between +4/-5 nT. Phi angle was predominately negative (towards the Sun) before fluctuating between positive and negative orientation after 24/0001 UTC. Geomagnetic activity remained Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) as measured at GOES16 has remained at Background levels. High energy electron flux (greater than 2MeV) at GOES16 was at predominantly background levels. Electron fluence levels remained well below Active (1e8 integrated pfu) levels. Observed fluence at 24/0001 UTC was 1.75e6 integrated pfu.

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Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain Low, with a slight chance of isolated M-class X-ray flares.

Solar Wind / Geomagnetic Activity: Several recent CMEs occurred on or close to the Earth-Sun line which could give glancing blows on passage. The CME from the C7 flare at 22/0727 UTC and a CME from the C4 flare of AR3151 at 22/1900 UTC are both likely to pass beneath Earth's orbit but may produce minor peripheral impacts on day 3 (26th).
Current background solar winds may become enhanced during day 1 (24th) due to the arrival of a HSS from CH47/+. Further enhancements are possible through the period, from either the weak passing CMEs or a from a connection to a HSS from CH48/+ on day 3 (26th). However, this is low confidence. Quiet geomagnetic activity is expected to increase to mostly Unsettled with a chance of Active and a slight chance of G1/Minor Storms on day 1 (24th). Activity remaining mainly Unsettled days 2 and 3 (25th and 26th), but still with the chance of Active intervals and a slight chance of G1/Minor Storm intervals. Becoming mostly Quiet day 4 (27th), with diminishing probabilities of Active periods or any G1/Minor Storms.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES16 is expected to remain at Background levels throughout. The high energy Electron flux (greater than 2 MeV) at GEO is forecast to be close to background at first, before rising to Moderate to High levels later in the period in response to the enhanced solar wind conditions possible later day 1 or day 2 (23rd or 24th). The persistence of any enhancement is low confidence. The associated 24-hour integrated fluence is expected to remain below Active (1e8 integrated pfu) throughout, albeit with a slight chance of rising above later in the period.

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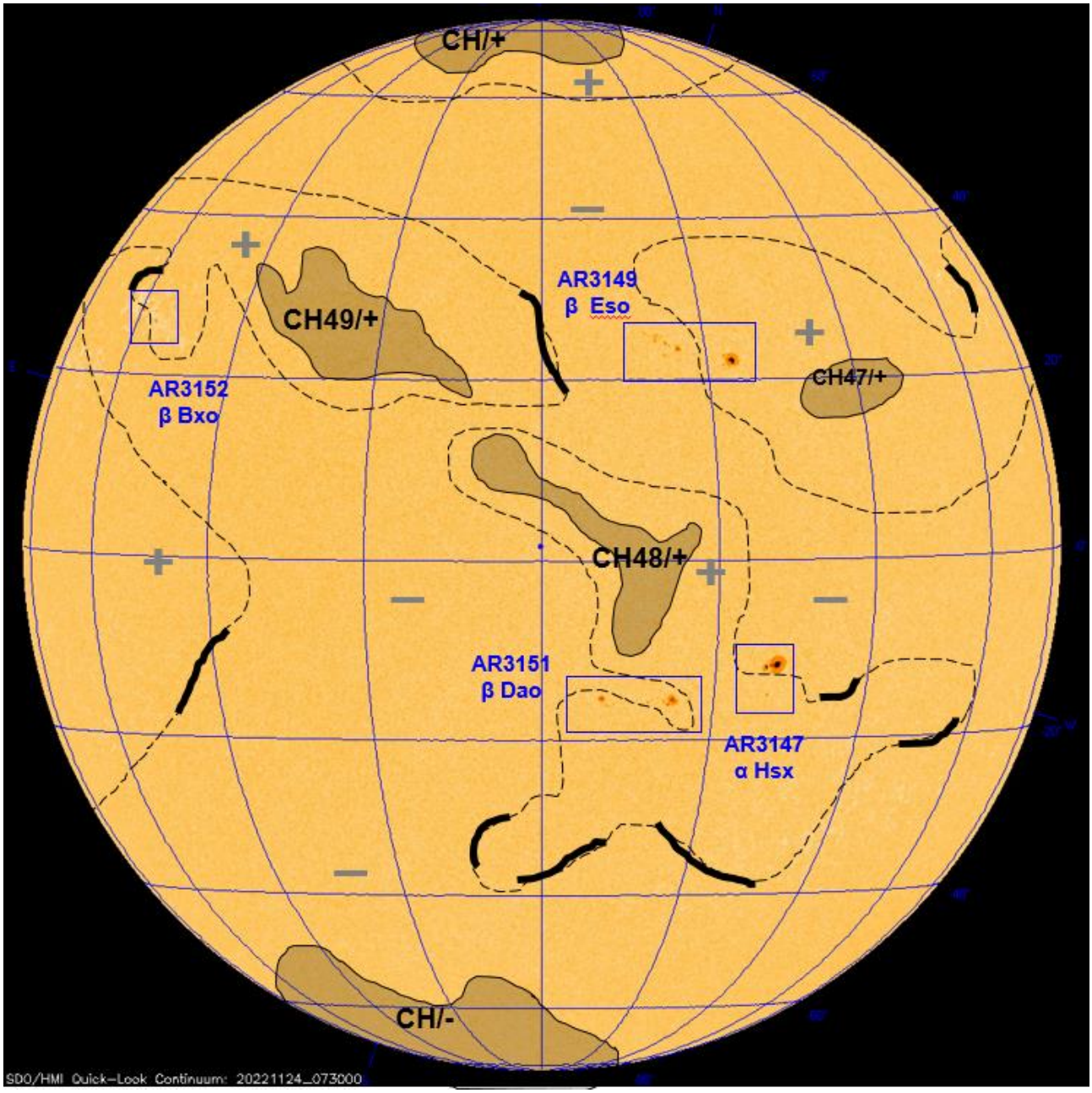
Figure 1. Solar Analysis Valid 24/0730 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

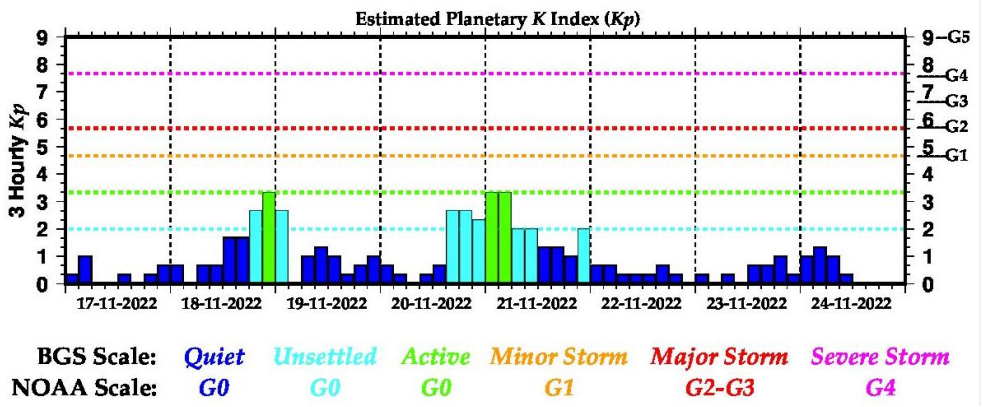
Several recent CMEs occurred on or close to the Earth-Sun line, which although may have some partially Earth-directed components, are likely to only give some minor effects if any arrival occurs. The CME from the C7 flare at 22/0727 UTC and a CME from the C4 flare of AR3151 at 22/1900 UTC are both likely to pass beneath Earth's orbit but may give a glancing blow with minor peripheral impacts on day 3 (26th).
Solar winds may become enhanced on day 1 (24th) due to the possible arrival of a high speed stream (HSS) from CH47/+. This enhancement would correlate with 27-day persistence which suggests arrival late on the 24th. However, MOSWOC Enlil does not support his enhancement, and as such confidence is low. Further enhancements are then possible due to a HSS from connection with CH48/+, which is expected to become geoeffective on day 3 (26th).
Quiet activity is expected to become largely Unsettled through day 1 (24th) with a chance of Active intervals and slight chance of isolated G1/Minor storms. Through days 2 and 3 (25th and 26th), activity is likely to be remain mostly Unsettled, with the chance of Active intervals persisting along with the a slight chance G1/Minor Storms given the potential for further fast wind and/or CME arrivals. Becoming mostly Quiet day 4 (27th), as the possibility of Active periods and G1/Minor Storms diminishes slightly.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	20	20	15
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected though there is a slight chance of a glancing blow overnight 24th/ 25th and again on the 26th.

Figure 2: BGS Kp is Quiet



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Radio Blackouts - X-Ray Flares:

Solar activity is forecast to remain Low throughout the period, with further C-class flares expected and the slight chance of M-class flares persisting throughout.
There are currently four sunspot regions on the visible disc. AR3151 in the southern hemisphere, historically the most active region, has shown further consolidation and spreading of its trailing spots, with no recent development observed. AR3147, in the southern hemisphere, has simplified and is now classified Hsx/Alpha. AR3149, in the northern hemisphere, has decreased in size, though remains Eso/Beta. AR3152 continues to emerge from the eastern limb, and is currently classified as Bxo/Beta.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) at GEO, as observed by GOES16 is currently at background levels and is expected to remain at this level throughout.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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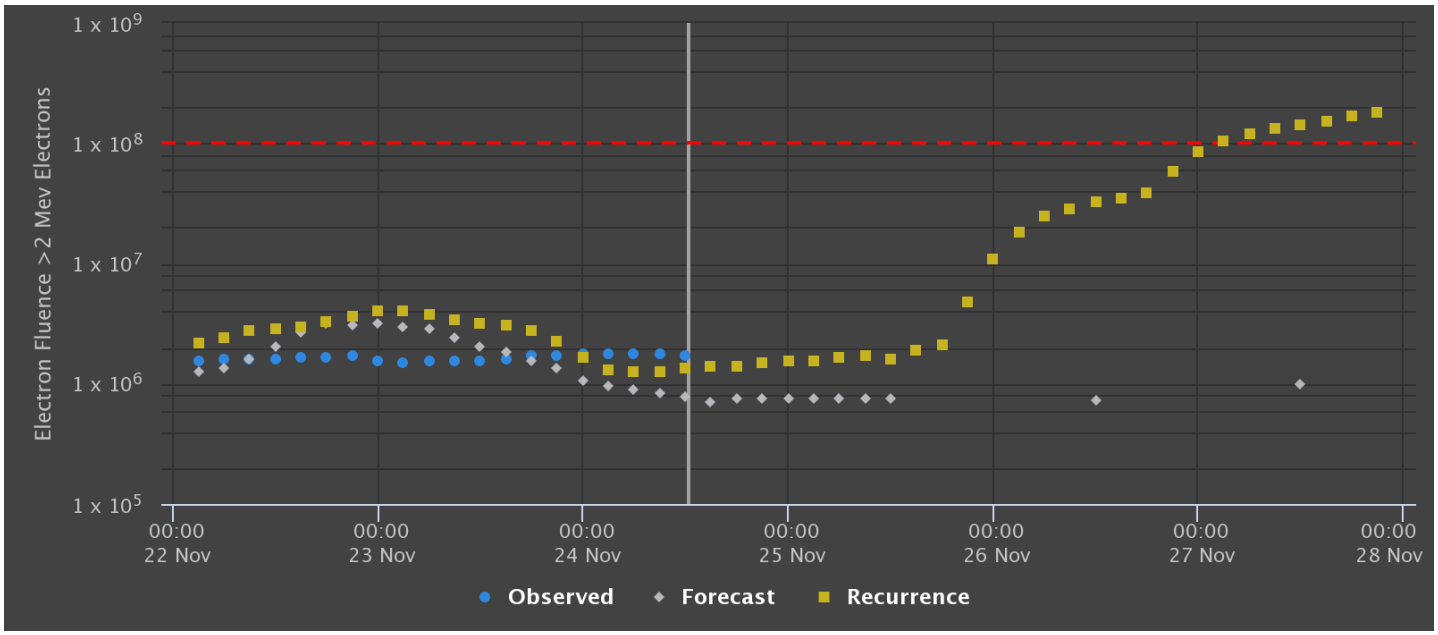
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2 MeV) observed by GOES16 is forecast to be predominantly Moderate in response to the arrival of a coronal hole HSS on day 1 (24th). Flux levels then remaining Moderate for much of the period, with a chance of peaking High later in the period. There is low confidence by day 3 (26th), due to the uncertainty in the arrival of fast winds and glancing blows from any potential CME arrivals which could act to suppress observed flux at GEO later in the period.
The associated 24-hour fluence is forecast to remain below the Active threshold, with a slight chance of rising to Active by the end of the period. REFM is currently maintaining background fluence levels, which is good guidance if the enhancement on day 1 does not occur.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	10	15	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REF Model- Fluence levels may increase in line with recurrence towards the end of the period.



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